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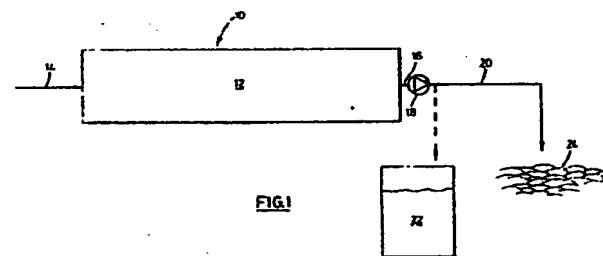
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⑯ Method and apparatus for cooling fish on board a ship.

⑯ An apparatus for cooling fish on board a ship is provided. This apparatus includes an ice-making machine (12) for producing fine particles of ice in a brine solution. Coupled to this ice-making machine are means (20) for directing ice from the machine to either a vessel (22) containing brine solution or to a catch (24) of fish. A method of cooling fish comprising producing a slurry of fine particles in brine solution in an ice-making zone and directing the fine ice particles onto either a catch (24) of fish or into a vessel (22) containing brine solution is also provided.

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METHOD AND APPARATUS FOR COOLING FISH ON BOARD A SHIP

TECHNICAL FIELD

The present invention relates to an apparatus and a method for cooling fish on board a ship.

BACKGROUND ART

It is desirable in fishing operations on board ships to cool fish soon after they are caught to ensure that they do not spoil. Conventionally, this is done by manually spreading large pieces of ice over the fish on board the ship. The disadvantages of doing this are that the fish are not cooled quickly, because the contact area between the ice and fish is small. Furthermore, the ice tends to freeze the fish because of the large amount of salt that is generally trapped in large pieces of ice. This freezing of the fish may result in spoilage of the fish due to later thawing and refreezing of the fish.

It is therefore an object of the present invention to obviate or mitigate the above-mentioned disadvantages.

SUMMARY OF THE INVENTION

According to the present invention there is provided an apparatus for cooling fish on board a ship comprising:

an ice-making machine for processing fine ice particles in a brine solution; and
transport means connected to an outlet of said ice-making machine for directing ice produced by said machine to either a vessel containing sea water or to a catch of fish.

In another one of its aspects, the invention provides a method of cooling fish comprising producing a slurry of fine particles in brine solution in an ice-making zone and directing the fine ice particles onto either a catch of fish or into a vessel containing brine solution.

The invention allows fish to be cooled in situ on board a ship, either by spraying ice directly thereon or by immersing the fish in a vessel containing salt water with ice on the surface thereof. Different types of fish require one or the other of these different methods of cooling. Also, the use of fine ice particles provides for better cooling of the fish because the particles have a larger surface area and the brine drains quickly therefrom. The brine quickly cools the fish while it drains and the fine ice particles completely cool the fish without freezing it.

Moreover, the use of a vessel containing salt water and ice provides a thermal storage unit which can increase the capacity of the ice-making machine. Pre-chilled seawater optionally containing ice particles can be obtained from this vessel to provide pre-chilled water for the ice-making machine and/or to provide chilled water for the condenser of the ice-making machine.

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BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention will be further described, by way of illustration only, with reference to the following figures in which:

Figure 1 is a diagrammatic illustration of an apparatus for cooling fish on board a ship;

Figure 2 is a diagrammatic illustration of an alternative embodiment of an apparatus for cooling fish on board a ship;

Figure 3 is a diagrammatic illustration of another alternative embodiment of an apparatus for cooling fish on board a ship;

Figure 4a is a partial sectional view of a portion of the devices illustrated in Figures 1, 2 and 3; and

Figure 4b is a cross section of the portion illustrated in Figure 4a taken along line A-A.

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BEST MODE

Referring first to Figure 1, it can be seen that an apparatus 10 for cooling fish on board a ship comprises an ice-making machine 12 capable of producing a slurry of fine particles of ice in a brine solution. The ice-making machine is of one of the designs disclosed in either U.S. patent no 4,551,159 issued November 5, 1985 (Goldstein) or U.S. patent application no. 739,225 filed May 30, 1985 (Goldstein), the contents of both of which are incorporated herein by reference.

Brine enters the machine 12 through an inlet 14, and a slurry of fine ice particles in a brine solution exits the machine through an outlet 16. The ice-making machine preferably produces a slurry of 30-60% ice. The outlet is connected to a pump 18 which is connected to a flexible hose 20. This hose 20 can be carried to either a vessel 22 containing salt water or to a catch of fish 24 to direct ice slurry produced by the machine 12 directly to the catch of fish 24 or (as indicated by the dotted line) to the vessel 22.

Figure 2 shows an alternative embodiment of

the apparatus for cooling fish. Components similar to those in Figure 1 will be given the same reference numeral, followed by the suffix "A". In this embodiment, the outlet 16A of the ice-making machine 12A is connected by a three-way valve 26 to either the vessel 22A or to the catch of fish 24A.

A line 28 leads from the three-way valve 26 to the vessel 22A to transfer ice to the vessel 22A. A second line 30 leads from the valve 26 to a separator 32 in which ice is at least partially separated from brine and is directed through the flexible hose 20A to the catch of fish 24A. The separator 32 comprises a screw conveyor with a screen disposed therebelow. The brine from the separator 32 is sent by a line 34 to line 28 via a pump 35 and is thereby sent to the vessel 22A.

Makeup brine is sent to the vessel 22A via a direct seawater line 36 or from a brine storage unit 38. An outlet 40 in the lower portion 42 of the vessel 22A is connected to the ice-making machine 12A to transfer pre-chilled brine to the ice-making machine. Agitators, such as water jets 44, are optionally provided in the vessel 22A to agitate the ice so that some ice is entrained in the pre-chilled brine sent to the ice-making machine 12A.

In this embodiment, the efficiency of the ice-making unit is increased, resulting in substantial cost savings and reduced space requirements for the machine, by using pre-chilled brine in the ice-making machine.

Figure 3 is an alternative embodiment of the apparatus of Figures 1 and 2. Elements similar to those shown in Figures 1 and 2 will be referred to by the same reference numeral followed by the suffix "B".

In the embodiment of Figure 3 some of the pre-chilled brine is sent to a condenser 46 of the ice-making machine 12B by a line 48. The warmed brine from the condenser 46 is then returned to the top of the vessel 22B for cooling via line 50.

In this embodiment, the use of the pre-chilled brine as a heat exchange medium for the condenser of the ice-making machine results in further increased capacity of the ice-making machine.

Referring to Figures 4a and 4b, another embodiment of the discharge end 60 of the flexible hose 20 used in any of the above-mentioned systems 10 is shown. This embodiment includes an ice slurry drier 62 connected to the discharge end of the flexible hose 20. The drier 62 comprises a housing 64 of circular cross-section having a lower sloping bottom surface 66, the surface being provided with a drain 67. The housing includes an inlet 68 connected to the flexible hose 20 having a diameter greater than the diameter of the flexible hose 20. An outlet 70 is also provided in the housing and has a diameter larger than that of the hose but less than that of the inlet 68. A closure

flap 72 is pivotally connected to the outlet 70 to seal the housing when ice-slurry is not being pumped therethrough.

5 A hollow cylindrical sieve 74 is provided in the housing 64 and extends between the inlet and outlet 68 and 70 thereof. The sieve 74 has a diameter substantially the same as the flexible hose 20 and directs the ice-slurry through the housing. The sieve 74 is also provided with a 10 plurality of spaced slots 76 on a portion of its circumference that extend along the entire length of the sieve 74.

In operation, the ice-slurry produced by the 15 ice-making machine 12 that is being discharged through the flexible hose passes from the hose 20 into the sieve 74. The longitudinally extending slots 76 do not impede the flow of the ice-slurry but allow excess brine to be drained from the ice-slurry. The excess brine passes through the slots 20 76 as the slurry moves along the sieve 74 and falls to the bottom of the housing 64. The sloped lower surface 66 directs the excess brine to the drain 68 so that the brine can be released from the housing. The drained ice-slurry passes through the sieve 74 25 to the outlet 70 causing the flap 72 to open thereby allowing the dried ice-slurry to be applied to the catch of fish 24 or to the vessel 22. It should be noted that the drained brine can be re-circulated into the system 10 or the drain can be closed to 30 prevent the drained brine from being released from the housing 64.

It should also be realized that the drier 62 can 35 be used in combination with the separator 32 to increase further the drying of the ice-slurry or can be used in the systems 10 without the separator to permit the drainage of brine from the ice-slurry if desired.

40 **Claims**

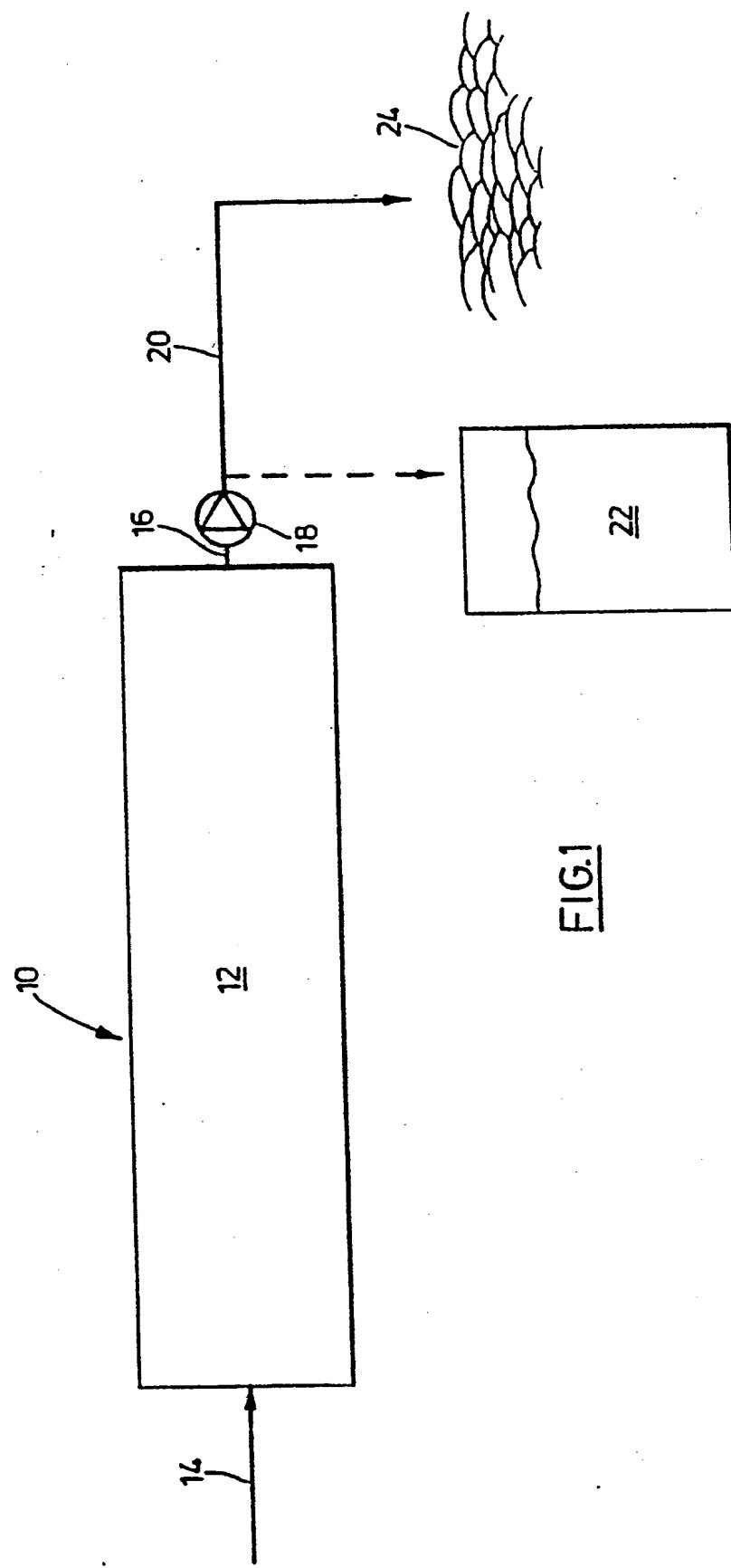
1. An apparatus for cooling fish on board a ship comprising:
45 an ice-making machine for processing fine ice particles in a brine solution; and
transport means connected to an outlet of said ice-making machine for directing ice produced by said machine to either a vessel containing sea water or to a catch of fish.

50 2. The apparatus of claim 1 wherein said transport means comprises a pump connected to a flexible hose.

55 3. The apparatus of claim 1 wherein said outlet of said ice making machine is connected by a three-way valve to both a flexible hose and to a line leading to said vessel.

4. The apparatus of claim 1 including said vessel; a brine inlet connected to said vessel; and a brine outlet connecting said vessel to the inlet of said ice-making machine. 5
 brine solution from said condenser is directed to said vessel.

5. The apparatus of claim 1 wherein an ice and liquid separator is associated with said transport means to separate ice from brine. 10
 6. The apparatus of claim 5 wherein said separator is connected to a line leading from an outlet of said ice-making machine, and wherein an ice outlet of said separator is connected to a flexible hose and a brine outlet of said separator is connected to said vessel. 15
 7. The apparatus of claim 4 including agitation means located in said vessel. 20
 8. The apparatus of claim 4 wherein said ice-making machine has a condenser and wherein said apparatus further includes a connection between said brine outlet and the inlet of said condenser, and wherein the outlet of said condenser is connected to said vessel. 25
 9. The apparatus according to claim 1 wherein said flexible hose includes means for separating ice from brine. 30
 10. The apparatus according to claim 9 wherein said means for separating ice from brine includes a cylindrical sieve having longitudinally extending slots provided therethrough. 35
 11. The apparatus according to claim 10 wherein said sieve is provided in a housing, said housing having a sloping lower wall and a drain provided therein, said sloping wall directing brine passing through said slots towards said drain. 40
 12. The apparatus according to claim 11 wherein said housing further includes a closure flap at the outlet end thereof. 45
 13. A method of cooling fish comprising producing a slurry of fine particles in brine solution in an ice-making zone, and directing said fine particles onto either a catch of fish or into a vessel containing sea water for storing fish. 50
 14. The method of claim 13 further comprising pre-chilling brine solution in said vessel of seawater and, sending said pre-chilled water to said ice-making zone to produce a slurry of fine ice particles in brine solution therefrom. 55
 15. The method of claim 13 wherein at least some of said brine solution is removed from said ice particles prior to directing ice particles onto said catch of fish.
 16. The method of claim 15 wherein the removed brine solution is sent to said vessel.
 17. The method of claim 13 wherein the contents of said vessel are agitated.
 18. The method of claim 13 wherein pre-chilled brine solution from said vessel is directed to a condenser in said ice-making zone and warmed



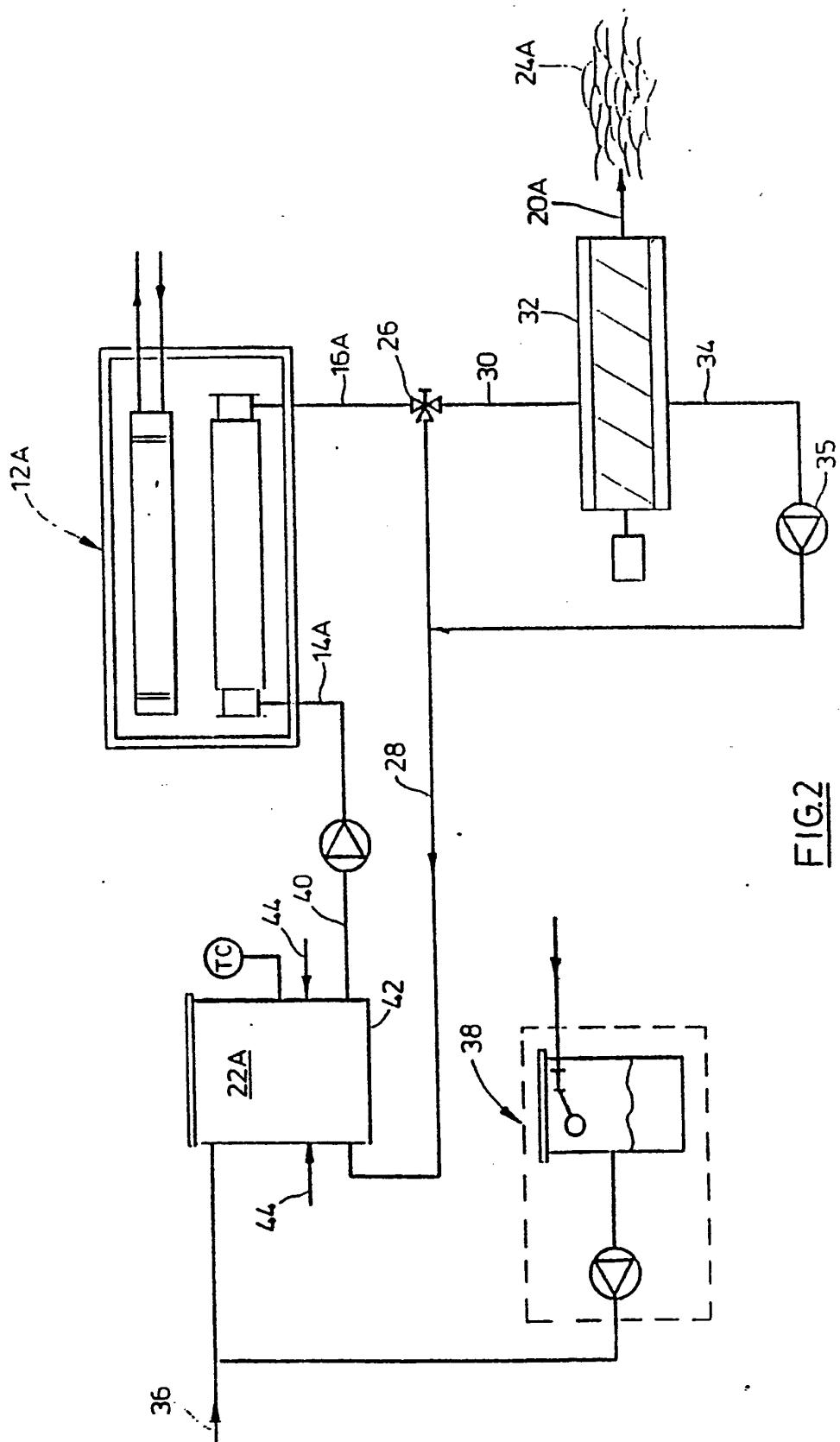


FIG.2

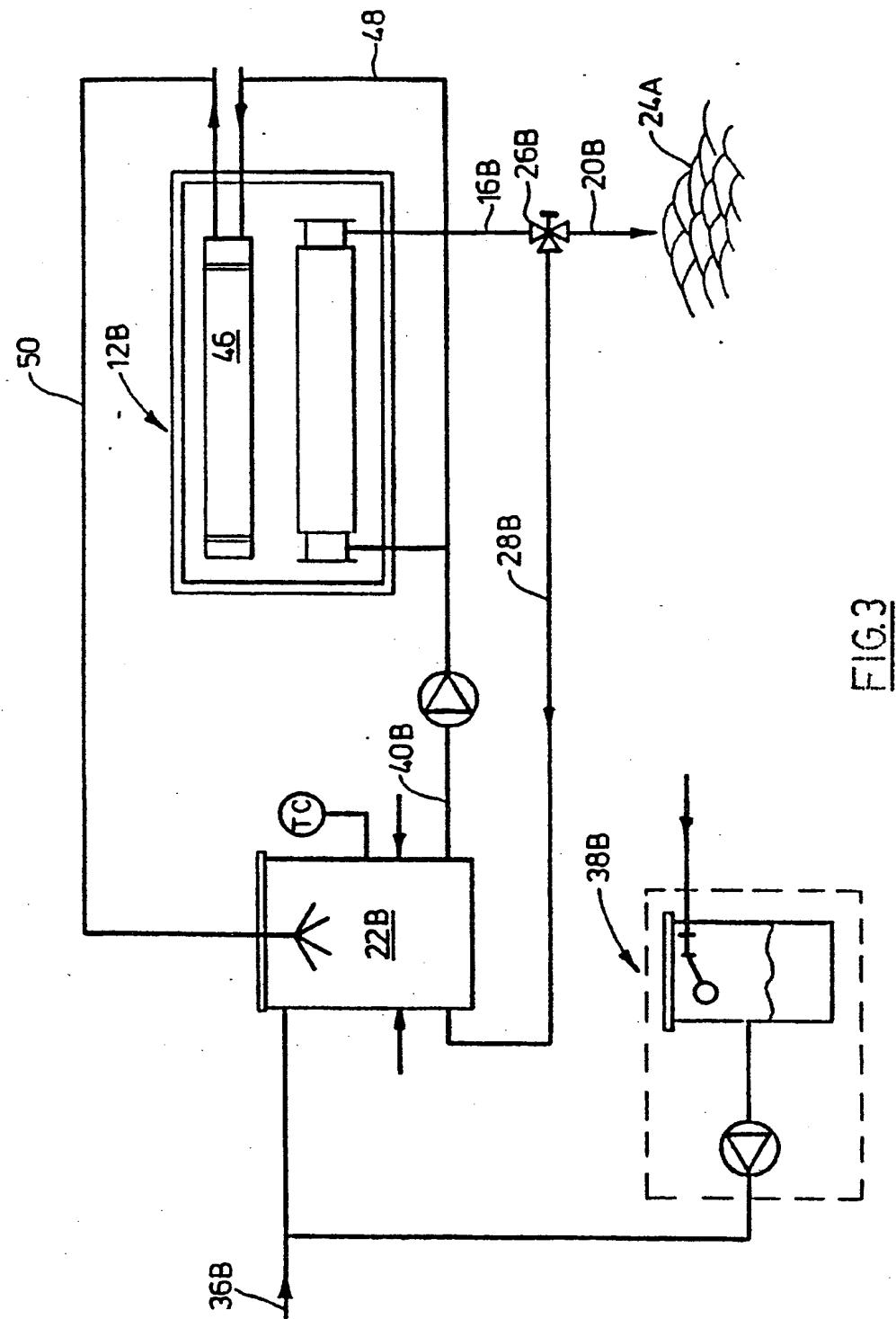


FIG.3

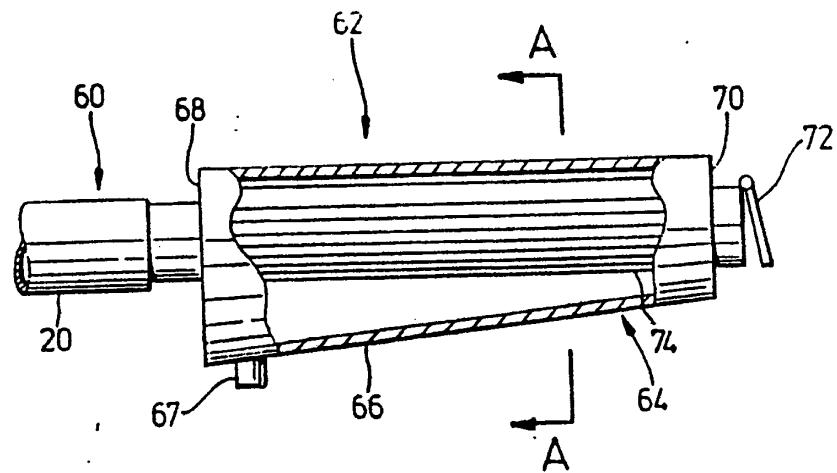


FIG. 4a

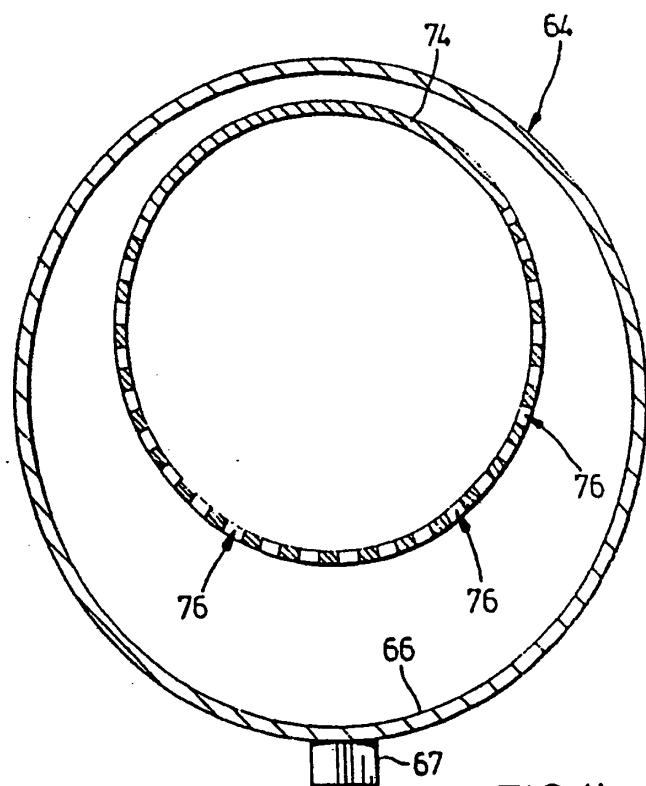


FIG. 4b



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	EP-A-0 168 537 (SUNWELL ENGINEERING) * Page 7, line 13 - page 20, line 15; figures 1,2 * ---	1,4-6, 13,14	A 23 B 4/06 F 25 C 5/00 B 63 B 35/24
A	GB-A-1 033 872 (VEB VOLKSWERFT STRALSUND) * Page 1, line 85 - page 2, line 43; figure * ---	1,2,5, 13,15	
A	DE-C- 668 100 (PINTSCH) * Page 2, line 45 - page 3, line 23; figure * ---	1,2,7, 13,17	
A	US-A-4 584 843 (PRONGER) * Column 4, line 55 - column 7, line 21; figures 1-19 * ---	1,4,5, 13	
A	US-A-4 509 344 (LUDWIGSEN) * Column 4, line 32 - column 6, line 7; figures 1,2 * ---	1,4,5, 13	
A	US-A-1 547 258 (NEWTON) * Page 2, line 49 - page 4, line 45; figures 1-7 * ---	1	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A	US-A-4 129 015 (MORRIS) * Column 3, line 28 - column 7, line 46; figures 1-7 * ---	7,10,15 -17	F 25 C A 23 B B 63 B F 25 D
A	US-A-4 341 085 (NAIL) * Column 5, line 24 - column 6, line 5; figure 3 * ---	8,18	
A	US-A-4 104 889 (HOENISCH) * Column 4, line 43 - column 12, line 64; figures 2-13 * ---	10,11, 15 -/-	
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		30-03-1989	BOETS A.F.J.
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Application Number

EP 88 20 1603

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A	GB-A-1 481 537 (DOUST) ---		
A	US-A-4 051 690 (DOUST) ---		
A	US-A-4 249 388 (BURNS) ---		
A	FR-A- 754 096 (LEBLANC-VICKERS) ---		
A	EP-A-0 107 755 (SULZER) -----		
TECHNICAL FIELDS SEARCHED (Int. Cl.4)			
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	30-03-1989	BOETS A.F.J.	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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